

EVALUATION OF PROJECT

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1. This evaluation is based on a thorough appraisal of the formal and informal reports submitted by the Itek Corporation under Project [redacted]. [redacted] The scope of the contract, as stated in the First Interim Report, can be divided into four major areas. These four areas, listed below, are used as the organization of this evaluation. The areas are:

- a. Photo Interpretation techniques and equipments.
- b. Photographic techniques and equipments.
- c. Photogrammetric techniques and equipments.
- d. Computer programs, index file, library support equipment and techniques.

2. Photo Interpretation Techniques and Equipments. a. Security restrictions forced the deletion of certain portions of the work statement dealing with photo interpretation. However, Itek was asked, and agreed, to investigate PI activities not subject to these security precautions (Page 87, 88, Second Interim Report). These activities, to which Itek had full access, were being conducted in the Target Materials Center of the 544th Reconnaissance Technical Group and in the 8th Reconnaissance Technical Squadron.

b. No specific reference to the results of any study of PI techniques and equipments appears in the report. Those portions of the report which deal with PI activities are slanted toward development of equipment and techniques that may be required two or more years from now. Little or no advice is provided on how to do today's PI job better with equipment now available. This area was completely avoided in Chapter II of the final report (Pages 3 through 6).

c. The report states a requirement for developing "better communications between photo personnel and the users of photo products." (Pages 12, 52, Final Report) No recommendations for such development are provided.

d. The report discusses general parameters of a "general purpose photo input system" (Pages 112-120, Final Report), the "overall integration problems" (Pages 124-129, Final Report), and PI viewers (Pages 133-136, Final Report). These discussions have merit and should be considered in future programming for the development of PI equipments and procedures. However, they contribute little to improving present capabilities and output of SAC PI activities. There is no evaluation of viewing equipment on hand, nor of means for improving the use of this equipment. On Page 2 of the Final Report the statement is made

that "more detailed specifications on these equipments (contact printers, P.I. viewers, comparators, and a resolution test camera) will be prepared in the near future." We have not received such specifications.

e. The requirement to evaluate existing techniques and equipment used to extract intelligence information from corollary information and make recommendations for improving such techniques and equipment was partially satisfied.

f. Recommendations were made on means of increasing compatibility between various photographic inputs and special or general purpose equipments.

g. Recommendations were made on new R & D projects designed to improve SAC's photo analysis capability.

h. No detailed SOPs on photo interpretation were submitted.

i. The requirement for a textual report on an analysis of the computer-plotter-mensuration system directed toward determination of additional computer programming required to exploit aerial reconnaissance photography and plotting was partially satisfied. There is no discussion in the report of the existing plotting function. No computer programs for exploiting the electropplotter were recommended.

3. Photographic Techniques and Equipments. a. The work statement includes the following (Pages 79 and 84, First Interim Report): "Primary consideration should be given to developing techniques which will insure that the optimum amount of intelligence information is extracted from photography through the preservation of original detail ..." and "An analysis of presently available or funded photographic processing, handling, and enlargement equipment, expendable materials, methods, assigned photographic processing personnel and working environment and recommendations for the production of higher quality (if possible) or different format photo product for the photo interpreter. (Products required: Textual report and samples of recommended products.)"

b. The Itek staff recognized the intent of the work statement in this area, as evidenced by the following statements from the First Interim Report:

(1) (Page 9.) "Our intention with regard to (the Special Projects Photo Laboratory) is to conduct a number of experiments to determine the degree and sources of photographic quality degradation encountered in this operation, and the effects of these degradations on the information derived by the photo interpreter and photogrammetrist."

(2) (Pages 54, 55.) "Our approach will be to examine the entire (Photographic) reproduction system for material mismatches; prepare a form which will provide a complete "biography" of each material which is currently used and will allow a decision to be made regarding suitability for the intended application. A portion of the information sought is available from the manufacturer's literature; however, a good deal of it is not, and will be determined in the Itek Research Laboratories in Boston. The establishment of this kind of information will then make it possible to predict whether the material will introduce degradation into the copy, and if so, to recommend another material."

"Our requirements in this area are to identify the inputs, outputs, the kind of tasks the Special Projects Laboratory is called upon to perform, and what kind of schedules it must meet."

(3) (Pages 74, 75.) "During the next month we plan to accumulate the kind of data that will allow an accurate evaluation of ... facilities and equipment, photo materials, work flow and capacity, and personnel; and we will explore a classical problem area: that of communication between the photo interpreter and the photo darkroom technician."

b. None of the above requirements is completely satisfied in the Itek report. Following are specific examples of inadequacies:

(1) Resolution tests (App C, Final Report) were made only on Type G-2 film under one set of processing conditions and were not made on all on-hand printing equipment.

(2) No comparison is given between resolution obtainable on other duping or printing materials or under other processing conditions.

(3) The "biography" of each material (see para 3 b (2), above) was not included.

(4) The evaluation of facilities, equipment, photo materials, work flow and capacity, and personnel (Page 74, First Interim Report) was not presented in recognizable and usable form.

(5) No guidance was given on the problem of communications between the photo lab and the photo user (Page 75, First Interim Report; Pages 12, 52 Final Report).

(6) No report is made on the effects of photo quality degradation on the information derived by the photo interpreter and photogrammetrist (Page 9, First Interim Report).

(7) Recommendations for new equipment are limited to brief, general statements of parameters for continuous roll film printers (Appendix A, Final Report).

(8) Laboratory tests (to include sensitometric response, spectral sensitivity, and resolution) on SO 278 duping film (Page 68, Second Interim Report) are not included.

(9) Tests of edge acuity and dimensional changes on multiple generation prints are not reported (Page 31, Second Interim Report).

(10) Sensitometric control methods required to maintain image quality through successive generations are mentioned but not discussed in any detail (Page 3, 5, 13, Final Report).

(11) The successful use of diazo materials for photo duplication is mentioned in passing (Page 13, Final Report). The subject is of considerable interest and should be fully developed.

(12) The report recommends the establishment of a special APS to identify precision photo lab technicians (Pages 4, 53, Final Report). We started work on this in September; a formal proposal has been submitted to D/Personnel. It appears that Itek's comments are based on our work.

(13) The report outlines a special training course for precision photo processing technicians (Pages 103-105, Final Report). Such a course is being given at Lowry AFB; SAC concurred in the curriculum, which closely parallels the Itek outline, on 1-2 June 1960. A more advanced course was given to selected SAC people at Rochester Institute in the summer of 1959. Again, Itek's recommendations appear to derive from an existing situation.

(14) The report recognizes a need for enlargements for briefings or other special purposes, but does not offer recommendations on methods, equipment, or materials for producing them (Pages 108, 109, Final Report).

(15) (Page 3, Final Report.) "The glass plates produced as 6P by standard methods are not suitable for photogrammetric or photo interpretation activities. Sensitometric control methods to correct this situation are recommended." Comment: the last sentence above apparently should read: "It is recommended that this situation be corrected by sensitometric control methods," since no recommendations are included in the report on how to affect this correction.

(16) (Page 4, Final Report) The initiation of design studies and procurement of high resolution continuous printers for 70mm, 5", and 9 $\frac{1}{2}$ " films is recommended. Comment: We question limiting this to continuous printers; step and repeat printers may be superior. Also optical and 35mm printers should have been considered.

(17) (Page 13, Final Report.) The report states that procedures for continually checking processing by sensitometric tests are required. Comment: We have recognized this and have accomplished it at March and Westover since the Eltrons were installed.

(18) (Page 57, Final Report.) The report states that "better equipment for both contact printing and enlarging will be dependent upon military procurement of not only new equipment, but on the funding of studies of the parameters which affect printing quality. In Appendix A, these factors are discussed in detail for continuous roll film printers." Comment: It was our understanding that this study was "funded" to determine "parameters which affect printing quality"; this it fails to do in any detail. The discussion in Appendix A is extremely general and quite brief and limited.

(19) (Page 148 et seq, Final Report.) Appendix C describes the tests of photographic resolution made by the Itek staff. Comment: The tests are inconclusive and very limited. They do not approach the scope indicated in paragraphs 3a, 3b(1), 3b(2), or 3b(3), above. Only one emulsion and one developing technique was used; no attempt was made to evaluate losses in multiple generation printing from extremely high resolution originals; several printers available to the 544th Reconnaissance Technical Group were not tested; the conclusions reached were generally well known prior to the tests; the effects of the degradation in quality on the information content was touched on lightly and in generalities.

4. Photogrammetric Techniques and Equipments. a. A valuable study was made on the effect of errors in using non-cartographic photography for control extension by aerial triangulation.

b. No recommendations are made on the computer-electroplotter system (see para 21, above).

c. No finished briefing is included on an analytical control extension program.

d. Recommendations for using various equipments in the Mensuration Branch include the following:

(1) 544th RTG cannot use the Nistri Beta II Stereoplotter efficiently or economically (Pages 3, 41, 42, Final Report).

(2) The Wild PUG-1 Point Marking Device is evaluated and recommendations for improvement are included.

e. Recommendations are made on the subject of pass point selection and mensuration techniques (Pages 38 et seq, First Interim Report). These are of value in the 544th RTG's aerotriangulation program.

f. The report states that an extensive testing program, utilizing the equipment and techniques available to the 544th RTG, is required in order to determine how each of the factors of aerotriangulation affect the end results (Page 41, First Interim Report). This program was completed, and contributed valuable data to the aerotriangulation and control extension program.

g. The need for methods and equipments required for handling "new and entirely different" photography, in a photogrammetric application is recognized (Pages 67, 68, Second Interim Report; Page 49, Final Report). Recommendations on this subject, on pages 99 through 103 of the Final Report, are general but provide preliminary guidance for future planning or operations. Proposals for viewing and mensuration equipment and techniques for handling these new formats of reconnaissance photography are also given on pages 120 through 122; these too are general and are slanted primarily toward development of an overall system design by USAF rather than toward developing the in-house capability of the SAC reconnaissance technical units.

h. The report contains recommendations on various analytical methods of tip and tilt determination and control extension. These recommendations are of value in providing direction for future work by the 544 RTG. (Pages 40, 43-45, 177-185, Final Report; 21-23, Second Interim Report.)

5. Computer programs, index file, library support equipment and techniques. Investigations and recommendations in this area are being pursued in a thorough and practical manner. This portion of the work statement is not considered to have been satisfied. At this date, the Itek Corporation's [redacted] presently working on the system analysis.

APPENDIX

A. Work Statement - Techniques Application Program

General

It is desired that the Itek Corporation develop, for SAC reconnaissance technical activities, a techniques application program whose prime purpose will be to enable these activities to improve the productivity of the photo analyst, and the rate and quality of his work, with particular reference to those photo analysis tasks which relate to the specific objectives of the Strategic Air Command. The term "photo analysis" is construed to include photo interpretation, photogrammetry, and other activities concerned in extracting intelligence information from aerial photographs. The contractor should examine in detail the mechanical, physical, and psychological factors which influence the productivity of the SAC operation, and make recommendations thereon. The program should describe in detail how to make the best man-machine match and how to best utilize existing equipment, and should produce recommendations for specific new research and development that will contribute to SAC performance. Photo analysis is an individual effort requiring complex decisions to be made by the interpreter. At the same time, there are many facets of the photo analysis operation that can be made more efficient and accurate through proper equipment design and coordination, and through the application of proper techniques. This will aid the individual to make those decisions which he alone can make, both more rapidly and more accurately. This is the general philosophy that should guide the development of the program.

General Approach

The program must consider two phases of photo analysis; the first dealing with identification (what is it), and the second with installation location (where is it). Not only must identification and location be accomplished accurately, but there is a constantly increasing pressure to shorten the real time in which such data is prepared. It is recognized that considerable overlap between the identification phase and the positional phase must occur. The program should consider where such overlap is advantageous, and where the operations should be distinct and separate. Manpower and equipment availability will obviously affect such decisions.

It is desired that a team of Itek personnel, who will possess appropriate security clearances, spend a considerable amount of time at the 544th RTGp and the 8 RTS, specifically to examine the photo analysis techniques, problems, equipment and its utilizations, and the present operations. The impact of new types of reconnaissance photography, which will include high volumes and various geometries, camera modes, formats, and scales, should be examined. It is also desirable that Itek conduct a review of the existing training programs for Photo Interpreters, and study those pertinent directives which detail the requirements for photo interpreters at the various SAC levels. The filing and retrieval problems for both photo and collateral materials should also be examined as they apply to the photo analyst.

Identification Phase

With this as a background, an analysis of the existing methods and techniques and of prototype and proposed new equipment should be made. The objective will be to point out the strengths and weaknesses in the present system, and in what direction research and development must go to strengthen the system. Interfaces between equipments and techniques must be explored and/or developed. Human engineering staff members should insure that recommendations are based on sound man-machine matches. Primary consideration should be given to developing techniques which will insure that the optimum amount of intelligence information is extracted from photography through the preservation of original detail and the application of supporting material from the graphic files or provided by other intelligence collection and exploitation systems.

Location Phase

This phase should deal directly with the improvement of positional information, which is a vital concern to this command. The program should first determine the responsibility of all contributing organizations, such as that of ACIC, to provide geodetic base information and charts, and should study the accuracy requirements as stated in SAC operational directives. Present and proposed methods, equipment, mathematical techniques, and results should be studied. The means for the best utilization of present equipment, including computer programming and scheduling, should be explored. Methods for improving positional accuracy, both by measurement from original material and by improvement of analytical techniques, should be specified. Statements concerning realistic accuracies, based on equipment errors and other sources of errors, should be included. Methods of extension of location information, using either analog or digital computations, should be explored, and computer programs developed.

Pertinent Activities at Itek Corporation

As the team members define problems during the early months of the study, it should be possible and desirable to have the Itek Corporation devote some theoretical and some experimental efforts to these problems at their Research Laboratories at Itek. It is understood that complete optical, photographic and mechanical equipment and qualified personnel are available as required to conduct such studies. In addition, studies which have been made in these areas previously, and which are available to Itek or this command, should be considered for their application to the problems outlined above.

Final Report

The final report should include, but not be limited to, the following:

- (1) An evaluation of existing techniques and equipment used to extract intelligence information from aerial photos and corollary information, and recommendations for improving such techniques and equipment.

- (2) Recommendations on means of increasing compatibility between various photographic inputs and special, or general, purpose equipments.
- (3) Recommendations for new research and development projects designed to improve SAC's photo analysis capability.
- (4) Detailed SOPs that will assist SAC reconnaissance technical units to implement recommended techniques.

B. 544th RTG - Specific Problem Areas

In addition to the areas outlined in the basic work statement for this project, the 544th Reconnaissance Technical Group has requested that the following specific areas be studied by the Itek Border Town group:

- (1) An analysis of computer, mensuration and plotting equipment available to the 544th RTG Analysis Center and the completed computer programs presently available to the 544th RTG with a view to determining and providing any additional programming required to enable the 544th RTG to exploit both advanced systems aerial reconnaissance products formats to the plotted positional stage of exploitation, (Products required: Textual Analysis report and final textual computer programs.)
- (2) Preparation of a briefing of recommended work flow, handling and operational procedures to be used by the 544th RTG Analysis Center and most likely to produce accurate, timely results in the exploitation of advanced systems aerial reconnaissance products of both format, by utilization of presently available or presently funded resources. (Products required: Textual briefing supported by finished graphic aids in either 30" x 40" or 35mm color format).
- (3) An analysis of equipment and personnel presently available to the 544th RTG Analysis Center utilized in the exploitation of aerial reconnaissance products, presently handled, and recommendations for more efficient utilization of these resources toward fulfillment of the SAC directed mission of the Analysis Center, 544th RTG. (Products required: Textual report and such graphic aids as are deemed necessary.)
- (4) Recommendation for the efficient reduction of special graphic and textual libraries to Alvac Computer storage and procurement of the necessary computer programs for Alvac Computer to enable the rapid retrieval of such data from the tape storage for use by photo interpreters. (Products required: Textual report, completed Alvac Computer programs, recommended EAM formats and such graphic aids as are required.)

- (5) An analysis of the aerial triangulation programs of the Analysis Center, 544th RTG and recommendations as to the most efficient means to achieve SAC directed goals in this field. Such an analysis should include a thorough review of available materiel, manpower and environmental resources as are presently available to the Analysis Center, 544th RTG and estimates of training required, available and recommended agencies where formal training may be and should be procured by assigned personnel in each of the particular specialties required and estimates as to the elapsed time required for attainment of the total SAC directed goals. (Products required: Textual report and a finished briefing in either graphic 30" x 40" briefing board or 35 mm color slide format of the results of the Analysis.)
- (6) An analysis of the photographic products in their several formats, available photo interpretation equipment and skill levels of assigned photo interpreters with an end to recommending:
 - (a) The most efficient photo format to be used in fulfillment of the various components of the photo interpretation functions to the 544th Analysis Center.
 - (b) The best of the available equipment to be used, with the recommended photo format, by the interpreters in the various components of the photo interpretation mission.
 - (c) Improved interpreter scanning techniques for more efficient exploitation of the photo source material.
 - (d) Improved production methods. (Products required: Textual report, sample work forms, data description forms, scanning measuring templates and finished briefing aids in graphic form.)
- (7) An analysis of presently available or funded photographic processing, handling and enlargement equipment, expendable materials, methods, assigned photographic processing personnel and working environment and recommendations for the production of higher quality (if possible) or different format photo product for the photo interpreter. (Products required: Textual report and samples of recommended products.)

ITL's Proposal for Additional Funding

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Comment #2

AFCIN-3H1 has reviewed the work statements submitted by the Information Technology Laboratories, and cannot find any records that would substantiate the work as ever being accomplished on 3H1 equipment.

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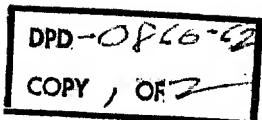
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JIM

February 2, 1962
REF: 9014-62-2C

Dear Jim:

Pursuant to our recent conversation, this is to advise you that I am extending the order covering the 407 Computer installed at Omaha through the month of February, 1962. This causes a net increase to this order of approximately \$5,500. I expect that you will appropriately amend the contract in the near future, in that I find myself in a rather critical funding position on BB-375.

If my understanding of our conversation is erroneous in any matter or form, would you kindly inform me of the nature of the discrepancy so as to minimize the extent of my liability.

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Very truly yours,



Contracts Manager

HAM:pjf

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BB-400
Prop Sec

Feb 5 1962